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ABSTRACT

Possible impacts of changing information technology on the role of the institutional researcher, who serves as a decision support intermediary, are examined. Attention is directed to measurement, human information processing, and decision support technology. It is noted that management information systems are dependent on measurement for data gathering, data processing, and the managerial inquiring and deciding subsystems. To illustrate a dimension of a measurement framework, seven maxims for institutional research (Hackman, 1983) are discussed; these are based on cognitive theory and provide insight on the trend in the role of the intermediary. In addition, concepts of the decision support system (DSS) are explained. Finally, the results of surveys of institutional research directors at Canadian and U.S. universities concerning the implementation of information technology and the use of DDS are described. It is concluded that the role of the intermediary is probably not threatened by existing information technology but that the intermediary should expand traditional activities to include aid for management's user-driven computing for decision support. The alternative is for these services to be run by data processing or administrative systems departments. (Author/SW)

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MEASUREMENT FOR DECISION SUPPORT

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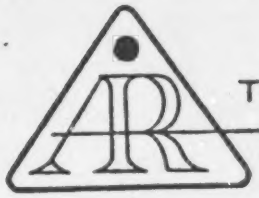

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twenty-Third Annual Forum of the Association for Institutional Research held at the Sheraton Centre in Toronto, Ontario, May 23-26, 1983. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
Forum Publication
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ABSTRACT

MEASUREMENT FOR DECISION SUPPORT

In order to explore possible impacts of changing information technology on the role of the decision support intermediary, that is, the institutional research analyst, three institutional research foundations, measurement, human information processing, and decision support technology are examined. The results of surveys of institutional research directors at Canada and United States universities indicate high levels of information technology implementation including perceptible use of decision support systems on at least one third of the campuses. The paper concludes that the role of the intermediary is probably not threatened by existing information technology but that the intermediary should expand traditional activities to include aid for management's user-driven computing for decision support.

MEASUREMENT FOR DECISION SUPPORT

Introduction and Perspectives

Practitioners must not only be aware of the potential and current use of information technology but also how rapid change in this technology changes the human context of decision support. A significant change in this context is the shift in relative use of information technology for institutional research by decision makers themselves, professional institutional researchers and support technicians. In order to explore the implications of the shift, we examine certain underpinings of institutional research, like measurement, human information processing and decision support systems (DSS).

Literature on information technology in institutional research is described in Sheehan, (1982). Some questions addressed there which are background to this paper are the following. What is the basic technology? What is its application in higher education, particular to management? What does experience with technology like instructional television and early computers tell us? What can we learn from other fields like futures research and social psychology? How should an institution proceed to implement new information technology? Literature on DSS has been updated and compiled recently in Sprague and Carlson (1982). Perhaps the best single reference for the "measurement" aspect is Mason and Swanson (1981) which distills the "Berkeley" approach to decision support with its emphasis on knowledge, inquiry and observation, that is, the generation rather than just the use of information.

Technology and the Role of the Intermediary

Software available on the ubiquitous micros matches the best available to decision support intermediaries a decade ago. Thus the engine of change is identified and its influence is increasing daily. A question that we seek a

definitive answer to is, what does this imply for the practice of institutional research - the role of the intermediary.

The widespread use new information technology by decision makers in the relatively autonomous units of institutions represents a challenge to the campus office of institutional research (OIR). The challenge is described in part by the following three questions. How does the intermediary maximize institutional benefits of decision support technology in departments, schools and other units? How does the OIR maintain and enhance its role as the institutional supplier of decision support? Will the OIR disappear because central decision makers will have their personal, mechanized decision support capability and no longer need the institutional research intermediary? We will return to this challenge toward the end of the paper.

Measurement

Measurement is the process of obtaining symbols to represent properties of objects, events, or states. Hence, measurement is a mapping between the world of real objects, events and states, and the abstract world of symbology. Symbols in turn are numbers called measures and have quantitative implications. This common view of measurement obscures measurement as influential information and emphasizes merely accurate information. This paper's focus on the decision maker as a user of measures is an appropriate one for institutional research. From this perspective we must also take into account the decision maker's disposition to act in certain ways. Therefore, concerns about who would use the measure, in what context and for what purpose, become an integral part of measurement processes (and the building of management information systems) as do concerns for data collection procedures, data precision and reliability.

Elements of a measurement framework were suggested by Churchman (1959) in the form of four existential measurement problems: in what language will re-

sults be expressed (language); to what objects and in what environments results will apply (specification); how can results be used (standardization); and how one can evaluate the use of the results (accuracy and control). Managerial measurement differs from scientific measurement in that it tends to move the emphasis from the thing measured to the user and her response to the measure. Three pragmatic questions concerning the user's disposition to respond to a measure in a prescribed way can be associated with the managerial functions of information. Identified by March and Simon (1958), these functions are: attention getting ("what problems should I look into?"), problem solving ("what course of action is better?"), scorekeeping ("how well am I doing?").

Figure 1 "Measurement and Information Systems" shows the dependence of MIS on measurement. Three information system components, the data gathering, the data processing, and the managerial inquiring and deciding subsystems as well as the real-world system are impacted by the measurement process, that is, by the rules and procedures for assigning numbers to objects, events or states.

Data gathering including sensing, observation, and recording converts primary observations of the real-world into data. Instrumentation and calibration of instruments are important for data gathering. The data processing subsystem maintains the data base and performs computation, editing and formatting functions as well as those of data organization, storage and retrieval--all according to the rules of the mapping and hence it should employ only those quantitative operations permitted by the units and measurement scales (i.e. nominal, ordinal, interval, ratio) defined by the underlying measurement systems. The managerial inquiring and deciding subsystem queries (based generally on issues of the attention directing, problem solving and scorekeeping variety), the data processing subsystem and converts the reports into information upon which decisions may be based. In some cases, such as with the use of optimization mod-

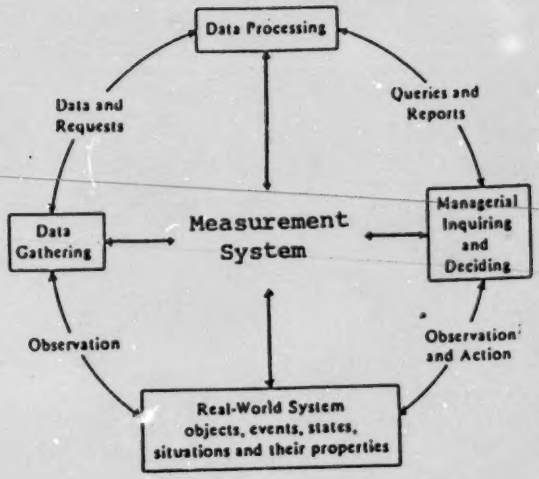

Figure 1: Measurement and Information Systems (Mason and Swanson, p. 21).

els, the data processing function may recommend courses of action. The manager's queries and the range of alternative actions available to the organization establish the criteria for the relevance and adequate precision of a measure. A measurement for management decision need only be precise enough to discriminate between critical magnitudes and to inform the decision maker relative to appropriate courses of action.

In order to relate elements of the several dimensions of the framework easily to the role of the intermediary, it is convenient to use the Three Hat Theory of institutional research (Sheehan, 1977). Figure 2 sketches the essence of this construct. It shows two alternatives that "D", the decision maker has. D may use DSS directly or through "I", the intermediary, in our case, the institutional research analyst. The institutional researcher uses DSS through "T", the technician who is a specialist in institutional information systems. In terms of the Three Hat Theory if I uses DSS directly he assumes the role of T--wears that 'hat' as well. To facilitate description of these two alternative modes of decision support, the figure also shows six channels of communications. Channels 1, 2 and 5 are for transmitting requests

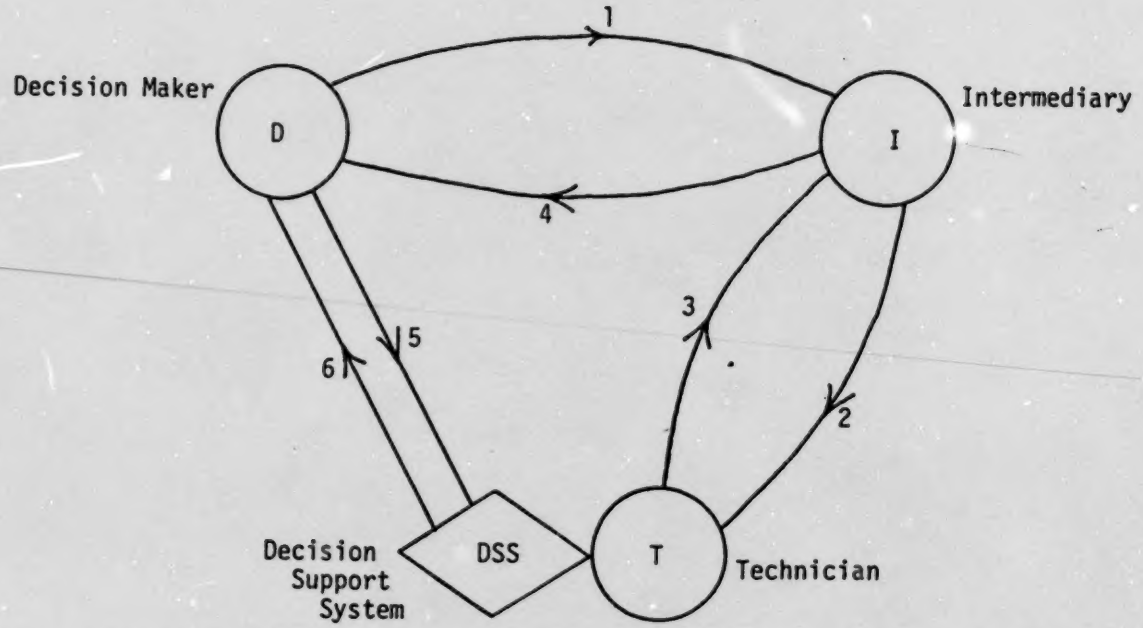

Figure 2: Alternative Modes of Decision Support

for information and for describing problems to be solved. Channels 3, 4 and 5 are for receiving data, information and alternative solutions. In comparing Figure 1 and Figure 2, the important question is whether the subtle relationships between the notions of measurement and those of information to support decision making will be taken into account by D without I. If not, then one has to consider a number of difficult questions. What is the nature of the consequence for the quality of decision making? Will these consequences be perceived as so significant that; (a) D will require an I? (b) D will spend the time necessary to take the measurement issues into account? (c) other?

Consider the alternatives. If we assume that D will require an I then one might ask whether the increased recognition of the significance of a measurement system underlying MIS/DSS will impact the role of the intermediary? If so, how? Alternatively, if we assume that D will gain the skills necessary to

take the measurement issues into account, then it is arguable that the trend to technologically improved DSS will probably lead to a decline in the intermediary role. Although as we argue elsewhere, an improvement in the quality of decision support information is likely to lead to even greater demands for decision support. The impact of this greater demand on I is hard to estimate.

Information system designers analyze decision processes as well as existing information flows. According to Mason (1981) this raises two important and closely related questions. These are, "what is the best point of articulation between the information system and the decision maker?" and "what is the nature of the assumptions which are incorporated in the information system and which frequently influence the user's decision making?". Both questions are relevant but we will concentrate on the second. This decision-oriented approach to design is characterized by the following sequence of activities: (1) a source consisting of physical activities and objects which are relevant to the institution, (2) the observation, measurement and recording of data from the source, (3) the drawing of inferences and predictions from the data, (4) the evaluation of inferences with regard to the values (objectives or goals) of the organization and choosing a course of action and (5) the taking of a course of action.

The specific types of assumptions made at each step are about: (1-2) measurements, (2-3) functional relations, (3-4) objectives and (4-5) information credibility. Each subsequent step in the information/decision process is influenced by all previous assumptions. This implies that without I, D should be aware of the assumptions at each point and be confident that he understands (to the extent necessary) the consequences for the action taken. It may be difficult to argue that this is not the ideal situation. Moreover, improving DSS technology permits the design of competent systemic information systems which

will help D expose and learn about underlying assumptions. But will a busy D want a system that helps him to learn --- that raises questions about assumptions rather than providing unequivocal decision support information? Typically, D does not use diagnostic tools. Therefore, it seems that if D's experience with DSS shows that the decision process must carefully account for these assumptions, the path of least resistance for D will be to turn to I rather than to a systemic information system.

The measurement of organizational productivity, measurements of individuals, e.g., students and faculty members, and measurement of the social context of higher education all provide further dimensions of the measurement framework. The literature in these areas give further issues which impact the measures used and hence the quality of decisions. There is only space here to acknowledge these as areas of further study and to offer one more example.

One of the intriguing problems of building a measure of organizational performance is to do so in a way that does not encourage behavior of individuals counter to the values of the institution. This illustrates another aspect of the intertwined nature of measurement and decision support and returns us to the type of question we asked before. What can we say about behavioral aspects in the context of the trend in the role of I? If D does not have special skills and interests in these behavioral aspects, will these sources of measurement invalidity seriously degenerate the quality of decisions?

Human Information Processing

In order to illustrate another dimension of a measurement framework we will use the seven maxims for institutional research (Hackman, 1983). These maxims not only have practical application to institutional research but since they are based on cognitive theory, they allow us to bring that field to bear on questions of the trend in the role of I.

1. More may not be better.

Basis: This maxim follows from the "bounds of rationality" notion, that is, the amount of information people receive, process and remember is severely constrained by cognitive limitations. Experts believe they can make use of large amounts of information but in reality they rely primarily on a few items.

Three Hat Theory consequences: The power of DSS allows D to drown himself in data. Such requests for too much data would be similarly transmitted by channels 1 and 5. Because a competent I may intervene through 4 and no such human intervention is possible in 6 it might reasonably be expected that D acting alone is more likely to overdo the data than if acting through I. Thus, it seems plausible to conclude that the presence of I contributes to decision quality. For channels 2 and 3, one would expect a tendency on the part of I to seek more information than I expects to pass on to D because I's decision includes how to present the data to D. Normally, one would expect 3 to contain more information than requested because the model allows T to have human intelligence. On certain details 3 would contain less than requested if T's data bases (or other DSS components) were unable to provide all the data required.

2. Augment humans with models

Basis: Experienced decision makers are much better at selecting and coding information than at combining and integrating (Libby, 1981).

Three Hat Theory consequences: Channels 1 and 4 amount to the DSS "dialog" with I providing data base management and model management services for D. Having interpreted the question from D, I uses the modeling capability and through channel 3 gets the results of the run. I may shield D from the technical work necessary to set the model up for a run but also from the resultant insights from these activities. I's challenge is to provide results of model runs in a form that is most useful to D. The maxim really addresses the use of DSS by D

through channels 5 and 6. The question suggested is whether D will have the combination of abilities and the inclinations to use the modeling capabilities of DSS, understand the results and make effective use of her time. There is a difference in making "hands-on" use of the modeling capability and asking someone else to simulate typical questions and then to discuss the results with you. At the present time not all D's have the keyboarding skills, the analytical techniques nor the detailed familiarity with the associated systems to play their own "what-if" games on their terminal. Most D's are more comfortable discussing alternative strategies and their consequences with I.

3. **Chunk your data wisely**

Basis: The span of human short-term memory is quite limited and people fail to account properly for correlations among pieces of information.

Three Hat Theory consequences: The maxim reinforces the practice of I to discuss as completely as possible the full "management problem' with D. As one of the respondents in this study reports "We have to know why we need that information before we can know how to provide it". I should suggest different ways of formulating the question so that when the answer is received through channel 4, both D and I will be confident that only the necessary chunks of information have been provided. Channels 2 and 3 provide I with the ability to use T to explore alternative chunkings, to test correlations and to work on methods of data presentation. Those D's aware of this maxim and able to use the capacity of DSS should be able to receive as good support directly as through channels 1 and 4. However, it seems reasonable to assert that implementation of this maxim is a technical activity and outside the purvue of the average D.

4. **Know your decision makers**

Basis: The best way to present information will be the best way for every-

one regardless of personal style of D.

Three Hat Theory consequences: Obviously, I must cater to D to whom he is in a special relation (i.e., boss, frequent client). However, too much attention to the idiosyncracies of one D (or one type of D) might lead to considerable bias in the formulation of the analysis and interpreting the results. The institutional perspective may be a practical way to help meet this maxim. This maxim is a challenge for D interfacing directly with a DSS. To be able to suppress (to know) one's own idiosyncracies with preparation of decision data is a valuable ability in part, because one is often required to bring others along with your decision.

5. **Heuristics are not always helpful**

Basis: People employ simplifying strategies to reduce the complex tasks of assigning probabilities and predicting values to simpler judgmental operations. These heuristics are quite useful but sometimes they lead to severe and systematic errors (Tversky and Kahanam, 1974).

Three Hat Theory consequences: There are certain "institutional" heuristics which D, I and T accept, in part, because of shared past successful experience. However, I, who is in the business of decision support ought to be sensitive to potential bias and take appropriate action. This is not easy because some of the heuristics used by OIR are buried in models and routines used in data gathering. Looking at channels 5 and 6, one can imagine a DSS which takes steps to alert D to typical systematic and predictable bias that might result from applying certain heuristics. DSS which employee heuristics are called expert systems. However, according to Barr and Feingenbaum (1981), "Current systems are limited in scope and do not have the same sense as humans have about knowing when they might be wrong." (p.10).

6. **Arrange tables by patterns**

Basis: Because of the cognitive limitations of short-term memory, numbers should be rounded and because of the need for "expert chunks" row and column averages or totals should be used. Since it is easier to scan up/down columns, the main patterns of data should be presented in columns. The order of rows and columns should make it easier to interpret a particular number by the general pattern of surrounding figures. (Hackman, 1983).

Three Hat Theory consequences: One of the advantages of DSS for some D is the ability of the support system to do the sort of spreadsheet type manipulations implied by the maxim. Therefore, D inclined to massage his own decision data may get considerable insight by arranging data tables according to the maxim. Most experienced I's and T's will have developed certain "home grown" rules which will be equivalent to this maxim.

7. **Negative evidence and new hypotheses are OK**

Basis: When decision makers remain open to alternative solutions and disconfirming evidence, decisions may be more effective. Since there is a tendancy towards "group think" action to avoid this should be taken.(Hackman,1983).

Three Hat Theory consequences: The dialog between D and I should include the opportunity for I to test negative evidence. Depending on the circumstance, I should provide information on a range of alternatives. Obviously, there are certain downsides to a relationship in which I is always the naysayer. Standard institutional research practice ensures that analytical methods implemented by T determine and test the range of alternative responses. In the case of D's direct use clearly the DSS allows for enhanced data retrieval and modeling. Thus, depending on D's analytical interest, capability and curiosity, D may or may not be inclined to search out and explore alternatives. Obviously, few if any existing DSS can thrust negative evidence and new hypotheses on to D.

Decision Support Systems

To bring the DSS dimension into this framework discussion it is necessary to characterize the DSS complex of concepts. The three levels of DSS technology are the specific decision support system (SDSS), the decision support system generator (DSSG) and decision support system tools (DSST). Since we are not concerned with building DSS we will not pursue DSST which are hardware and software elements that facilitate the development of SDSS and DSSG. Examples include graphics editors, report generators, conversational operating systems. Following the Sprague and Carlson (1982) nomenclature, SDSS includes the hardware and software that a decision maker uses to deal with specific sets of related problems. The DSSG is a package of hardware and software which provides a set of capabilities to build SDSS quickly and easily.

The performance objectives of SDSS are given by Sprague and Carlson as, to support: (1) hard, unspecified or unstructured decisions as well as structured decisions; (2) decision making at all levels of the organization and to integrate between levels where appropriate; (3) the communication between decision makers so as to support independent decision making; (4) all phases of the decision making process and facilitate interaction between the phases; (5) a variety of decision making processes but not be dependent on any one; (6) ease of use and modification in response to changes in the user, the task, or the environment.

In order to design systems to meet these objectives, it is valuable to identify a set of capabilities or characteristics of SDSS and DSSG which are independent of any particular decision process and decision maker style, skill and knowledge. Given the difficulty that decision makers have in describing the decision process and in describing decision maker characteristics, this process independent approach allows us to compare decision maker's requirements

with the components of SDSS. The components are identified as ROMC - that is:

R - **Representations**: decision making depends on the conceptualization of the information used particularly when expressed as physical representations on media such as scratchpads, blackboards and computer monitors. These Rs are important when D wants to communicate and provide the context within which users interpret outcomes and interact with the computer based system.

O - **Operations**: these are the abilities of SDSS which support the activities associated with the various stages of decision. Typical operations provide support of the following sort; query the data base, update lists, print alternatives, as well as others associated with decision aids such as simulation models.

M - **Memory aids**: to support R and O a number of types of memory aids are possible such as; data bases, views of data bases, workspaces on the monitor, triggers to remind the user that certain operations may need to be performed.

C - **Control mechanisms**: decision makers need control mechanisms to use R, O, and M in building a decision making process that suits their individual skills, styles and knowledge and in fact, in acquiring the new skills, styles and knowledge needed to use SDSS effectively.

The DSSG must permit quick and easy development of SDSS and must be flexible and adaptive to accommodate the iterative design process by which SDSS respond to changes in the problem context, the user or the task. The DSSG component capabilities are those necessary to meet these objectives in the form of the ROMC. Specific DSSG capabilities for, dialog management, data management and model management (DDM) are summarized in Figure 3.

The dialog component is the means through which the user communicates with the machine. Thus, a well-designed dialog component is a necessary but not sufficient ingredient for a successful DSS. In the future, according to

DIALOG	DATA	MODELS
Variety of output formats and devices	Variety of data forms and types	Library of models to constitute a model base
Variety of user input devices	Extraction, capture and integration	a) many types
Variety of dialog styles and ability	Data access functions	b) maintain, catalog,
Support communications among users and with builder	a) retrieval/query	c) full "canned" library
Support knowledge base of users (documentation)	b) report/display	Model building facility
Capture, store, analyze, dialog usage (tracking)	c) user-efficient	Model manipulation and use facility
	Data base management function	Model base management functions
	Variety of logical data views available	Model documentation
	Data documentation	Tracking of model usage
	Tracking of data usage	Flexible and adaptive model support
	Flexible and adaptive data support	

Figure 3: DSS Generator Component Capabilities (Sprague and Carlson, p. 313)

Sprague and Carlson, "...color display terminals and printers capable of producing extremely high quality outputs and easier-to-use input devices (e.g. voice input) will be the most noticable hardware components. Software will become available for these devices, but implementing the dialog component is likely to remain difficult..." (p. 218).

Viewed from the basis of progress in information technology in the past decade, DSS capabilities in terms of ROMC and DDM, have made remarkable progress. The user has friendly access to decision aids that in many respects are powerful and useful. However, compared with the other extreme, that is an informed intermediary, the modern DSS has severe limitations. Awkwardness in the person-machine interface is still present and the machine's lack of ability to act "intelligently" forces D to accommodate problems to the machine's input and problem solving style and interpret the responses as the machine presents them.

Progress will be made in the scope of decisions for which DSS can be helpful. Also, it seems likely that progress made with respect to the computer literacy of managers will gradually translate into an increase in the number of

decision makers willing and able to accommodate to the machine's style in order to reap the benefits. It is therefore reasonable to assume that there will be an increase use by D, but on the basis of this "technology scan" of DSS capabilities, it is not evident what impact that increase will have on the role of I. One might expect that today the greatest users of DSS are T, followed by I then by D. It would be interesting if (a) data were available to confirm or reject that assumption, and (b) longitudinal data were available to monitor trends. Again, on the basis of this technology description one might expect use by all three users to increase.

Artificial Intelligence and the Intermediary

Each of the dimensions, measurement, the maxims, and DSS suggest an intermediary role which includes the conversion of the manager's problem description into one that can be acted on by a DSS as well as the transmittal of DSS output in a form the manager can have confidence in and use. The real threat to these roles of institutional researchers comes from the possibility that the information technology revolution will produce an "intelligent" interface that can perform the interpretations currently done by I.

The fifth book in the Addison-Wesley series on decision support contains a chapter on artificial intelligence research by Gorry and Krumland (1983). They make the following observations which seem apt.

> If we could glean from the activities of intermediaries or consultants the principles and strategies they employ, and if we could codify this knowledge, then we could build DSS that would have a substantial impact on unstructured managerial problems. Unfortunately, at present, relatively little is known about the exact nature of the cognitive skills that consultants use...It is here that the interest of DSS developers may intersect those of researchers in artificial intelligence." (p.209).

The goal of artificial intelligence research continues to be the production of computer programs exhibiting intelligent behavior. However, Gorry and Krumland note that a theory of knowledge is likely to prove as important to DSS as to the field of artificial intelligence and then go on to draw the following conclusion:

> ...although artificial intelligence research may provide some technological innovations to benefit DSS design, the solution of the substantative intellectual problems of artificial intelligence will not come in the near future. Therefore the ad hoc development of DSS for particular applications will remain the rule (p. 218).

Survey of Practitioners

Table I gives a snapshot of the state of information technology in institutional research in Canadian universities in 1982 and United States universities in 1983. In Canada 36 questionnaires were mailed and 35 responses are included in the results. Questionnaires were sent to the senior institutional research person (or member of AIR) on practically every university campus. In the United States, questionnaires were mailed to 50 universities and 44 responses are included in the results. Questionnaires were sent to the "Director" of institutional research on one campus in practically every state.

The results show that while the vast majority of offices have computer terminals, less than half of the senior persons reponding use the device. There seems to be a fair amount of technology used in these offices in the form of word processing equipment and microcomputers. Although nearly a third of the campuses offer an electronic mail service, only a few senior practitioners personally use it. Interestingly, no one reported use of videodisc equipment.

TABLE 1

INFORMATION TECHNOLOGY USE IN INSTITUTIONAL RESEARCH

Activities, Opportunities and Director's Opinions Surveyed	United States Universities[1] 1983[3]			Canada Universities[2] 1982[4]		
	Yes #	No #	Yes %	Yes #	No #	Yes %
Department has a Computer Terminal	39	5	87	28	7	80
Director Personally Uses Computer Terminal	16	28	36	16	19	46
Department Regularly Uses						
Word Processing Equipment	32	12	73	21	14	60
Videodisc Equipment		44	0		33	0
Computer Color Graphics	7	37	16	6	27	17
Mini/Micro Personal Computers	18	26	41	10	23	29
Institutional Electronic Mail System on Campus	12	33	27	12	22	34
Director Personally Sends/ Receives E-M Messages	6	37	14	5	30	14
Department Using Computer-Based Simulation Models	27	17	61	23	10	66
For:						
Budgeting	15		34	15		43
Planning	16		36	13		37
Scheduling	1		2	4		11
Space Allocation	1		2	6		17
Administrator(s) on Campus Use DSS	17	24	39	13	22	37
Department Has Been Involved With DSS Through:						
Use	4		9	9		26
Development	8		18	9		26
Purchase	4		9	2		6
Evaluation	4		9	3		9
Campus Environment is:						
Data File	11		25	4		11
Data Base	5		11	7		20
Mixed	24		55	19		54
Other	1		2	3		9

TABLE 1 (continued)

INFORMATION TECHNOLOGY USE IN INSTITUTIONAL RESEARCH

Activities, Opportunities and Director's Opinions Surveyed	United States Universities[1] 1983			Canada Universities[2] 1982		
	Yes #	No #	Yes[3] %	Yes #	No #	Yes[4] %
Over the Next Five Years, Changing Information Technology Will:						
Influence IR practice on campus significantly	40	3	91	29	5	83
Influence your own professional activities	36	4	82	31	4	89
Be generally good for universities	41	0	93	28	2	80

1 The forty-four offices included: U. of Alabama in Birmingham, Alabama State U., U. of Arkansas, Atlanta University Center, California State U.-Northridge, U. of Central Florida, U. of Cincinnati, U. of Colorado System, U. of Connecticut, Cornell, Duquesne U., Eastern Washington U., Harvard, U. of Illinois, Kansas U., Louisiana State U., Louisiana State U. System, U. of Maryland, U. of Massachusetts-Boston, Michigan Technological U., U. of Michigan, U. of Minnesota, U. of Mississippi, U. of Missouri--Kansas City, U. of Missouri, Montana State U., U. of Nebraska-Omaha, U. of Nevada System, U. of New Mexico, U. of North Carolina at Asheville, U. of North Dakota, Northern Kentucky U., Ohio State U., Portland State U., U. of Rochester, U. of South Dakota, U. of Southern California, SUNY at Binghamton, Utah State U., Virginia Polytechnical Institute and State U., Western Michigan U., U. of Wisconsin-Eau Claire, Yale.

2 The thirty-five offices included: U. of Alberta, U. of Athabasca, U. of British Columbia, U. of Calgary, Carleton U., Concordia U., U. of Guelph, U. of Laurentian, Laval U., U. of Lethbridge, McGill U., McMaster U., U. of Manitoba, U. de Montréal, Mount St. Vincent U., U. of New Brunswick, U. d'Ottawa, U. du Québec à Montreal, U. du Québec à Rimouski, U. du Québec à Trois-Rivieres, Queen's U., U. of Regina, St. Mary's U., U. of Saskatchewan, Simon Fraser U., Télé U., U. of Toronto, Trent U., U. of Victoria, U. of Waterloo, U. of Western Ontario, Wilfrid Laurier U., U. of Windsor, York U.

3 Percentage column is percent yes of total 44 respondents.

4 Percentage column is percent yes of total 35 respondents.

Most offices are using simulation models and of those which are, more than half are using them for budgeting and planning. In addition, at least one respondent identified one of the following as supported by computer-based models; revenue forecasting, space entitlement, enrolment projection, institutional grant allocation, collective bargaining, use of endowments, student loans, tuition analysis, salary and other financial studies, student and faculty flow. In order to get some insight into the broader level of information systems on university campuses, each respondent was asked to place his or her institution in a simple spectrum. Some 55% said the environment was mixed.

Over a third of the respondents could identify an administrator using DSS. Given the broad interpretation possible, the questionnaire proposed the following working definition of DSS "For purposes of this study, let's agree that a decision support system (DSS) is a computer-based system which assists managers in their planning, problem solving and judgment with respect to tasks which cannot be routinized. DSS tend to be personal tools under the individual decision maker's control and may even be tailored to his/her terminology."

The overwhelming majority of respondents said information technology would significantly influence the practice of institutional research, would influence their own professional activities and would be generally good for universities.

Unless the trends in the role of the intermediary are monitored, institutional researchers will have difficulty anticipating what decision makers will expect of them. The results of this informal questionnaire were intended to provide a general picture of the use of information technology in institutional research and to determine whether there are sufficient examples of DSS use to warrant a more detailed investigation. It would appear that there are sufficient instances of DSS use that studies to determine more information about systems (hardware, software and networks), users, uses, and institutional re-

search involvement would be valuable. It would be useful if measures of effectiveness could be included in the data gathering, especially if enough cases with and without I were studied to permit generalizable conclusions. Studies over time are important while technologies are changing so rapidly.

Favorite Stories, Signals and Symbols

The "favorite stories" gathered by the survey are given in Sheehan (1983). These provide cases of how the results of an otherwise uneventful project produced information which, once in the hands of a decision maker, led to disasterous, incorrect or humorous results. There is not space in this paper to associate each story with the elements of the framework. In a review of stories about the gathering and use of information in organizations, Feldman and March (1981) observed that organizational units with information-processing responsibilities are unlikely to remain neutral with respect to the uses of information. They concluded that "information use symbolizes a commitment to rational choice. Displaying the symbol reaffirms the importance of this social value and signals personal and organizational competence" (p. 182).

Concluding Notes

To the extent that rationality in decision support will prove to be a significant factor in DSS use and the evolutionary role of the intermediary, it would seem that the Three-Hat-Theory role of I is not threatened by rapidly changing information technology. However, rationality is not the only decision paradigm. Increased analytical ability in decentralized units should intensify institutional research and raise the level of institutional research practice. It is hard to speculate, in the absence of experimental evidence, on organizational transformations that might occur but it seems unlikely that central decision makers working alone with their personal technology will be a match for the technically armed collectivity arrayed against them.

Following the rationale of the modes of OIR operations, (Sheehan, 1972) the model that might evolve is that of the information center which is rapidly gaining acceptance in many organizations (Martin, 1983). The information center concept assumes a high level of information technology implementation on campus such as characterized as follows. Most users have easy access to a terminal, most data are on-line, most programs are based on canonical data models and the DP department creates and maintains the data bases, networks and infrastructure necessary to support end-user application development including the use of fourth generation nonprocedural languages. This scenario may not describe many campuses today but it is a fair short-term forecast. This returns us to the original question. What is, under these highly automated circumstances, the most likely, practical, productive role for OIR to play during this period of the information technology revolution?

If the notion of OIR in the above context proves viable, then the role of the I becomes, in part, that of providing support for management's user-driven computing. This places the evolution of institutional research in a positive stance pressing for the sensible and practical introduction, adaptation, evolution of those technologies which in the judgment of the intermediary would be most effective and efficient for higher education management. The alternative is for these services to be run out of data processing or administrative systems departments. The disadvantage of this latter model is that the computing science base is not as relevant to decision systems as is the broader institutional research perspective - the perspective of the intermediary.

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